

April 15, 1941.

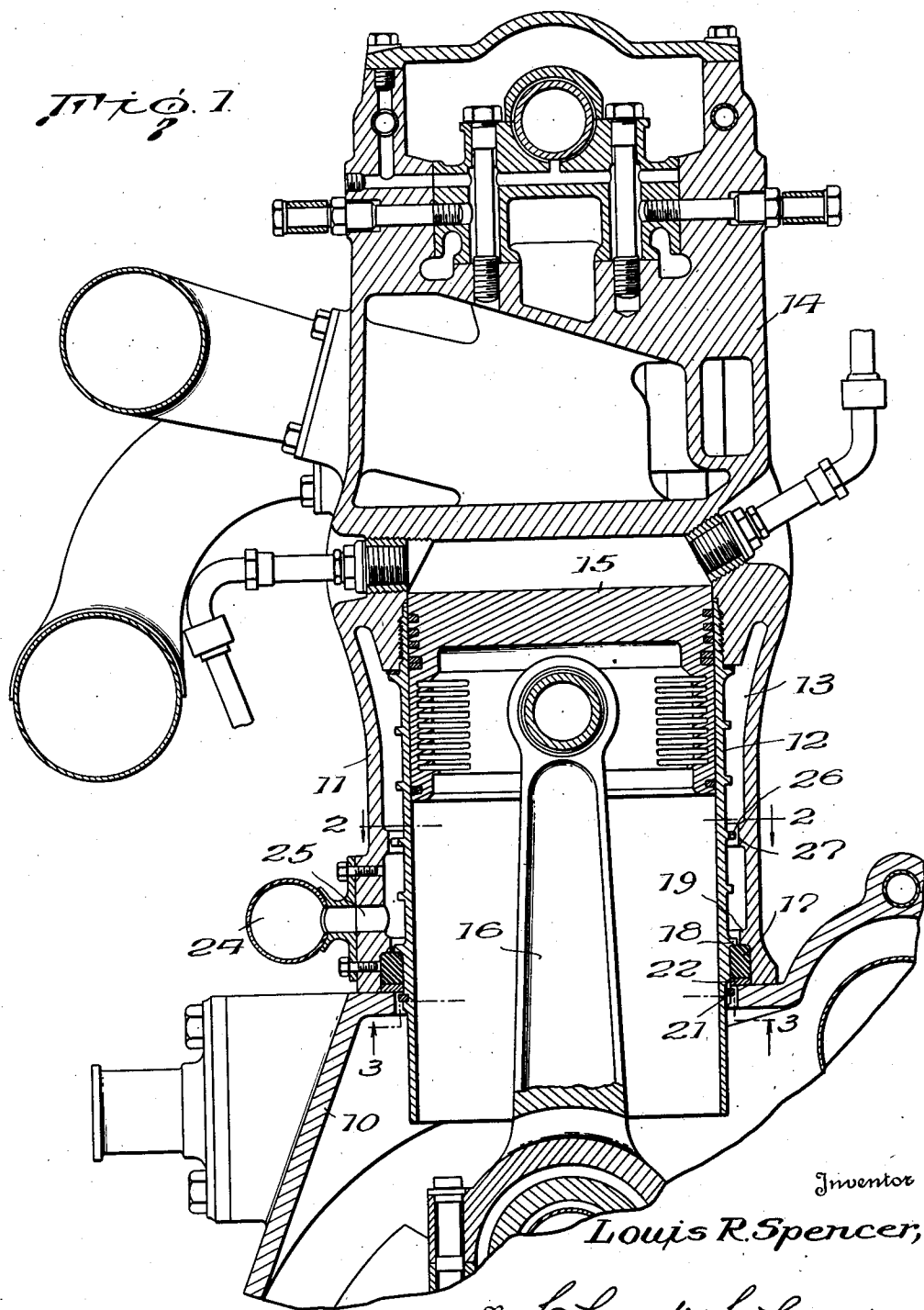
L. R. SPENCER

2,238,404

INTERNAL COMBUSTION ENGINE

Filed Sept. 19, 1939

2 Sheets-Sheet 1



Inventor

Louis R. Spencer,

By *Church & Church*

His Attorneys

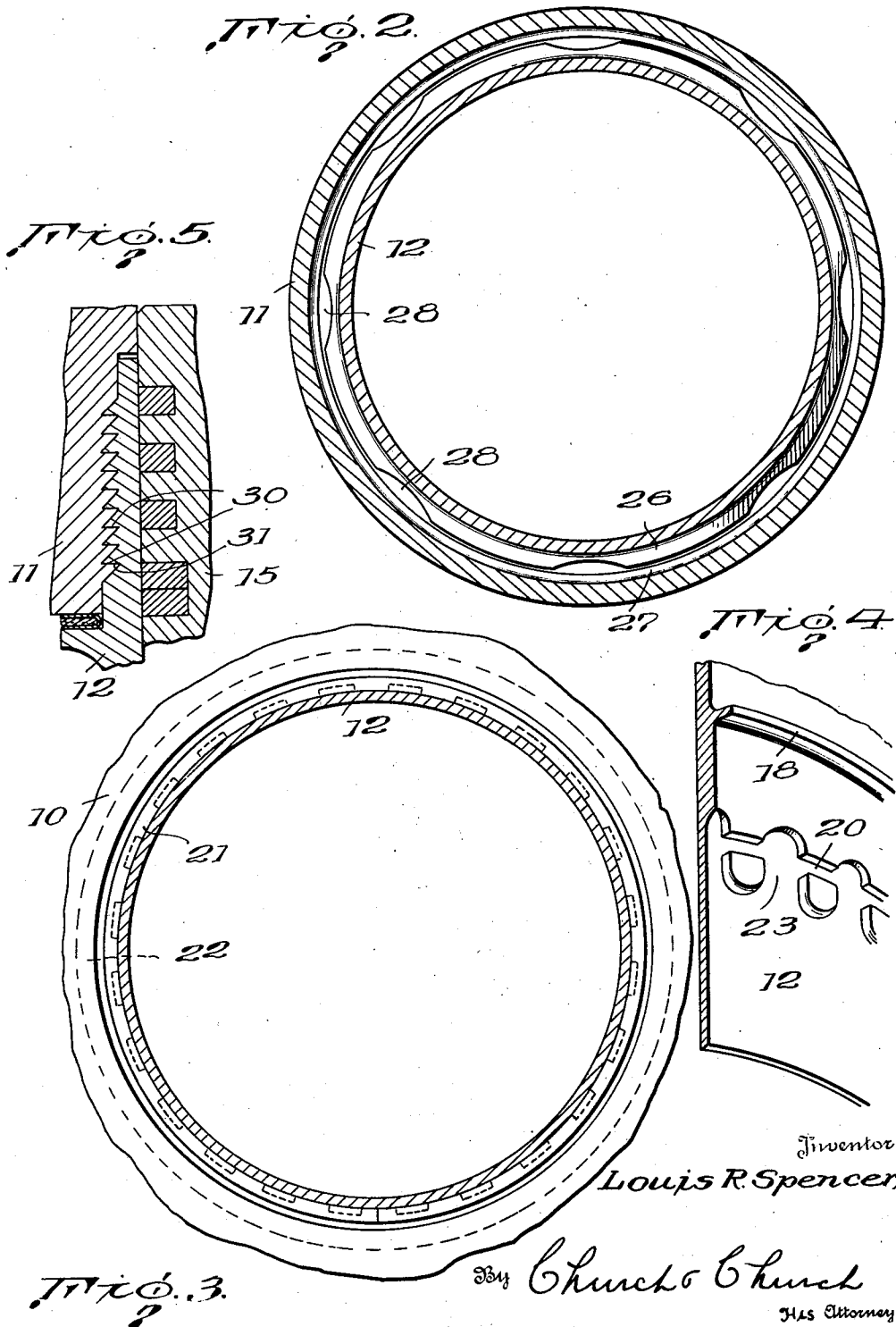
April 15, 1941.

L. R. SPENCER
INTERNAL COMBUSTION ENGINE

2,238,404

Filed Sept. 19, 1939

2 Sheets-Sheet 2



Inventor
Louis R. Spencer,

By *Church & Church*

His Attorneys

UNITED STATES PATENT OFFICE

2,238,404

INTERNAL COMBUSTION ENGINE

Louis R. Spencer, West Hartford, Conn., assignor
to Spencer Aircraft Motors, Inc., Hartford,
Conn., a corporation of Connecticut

Application September 19, 1939, Serial No. 295,662

4 Claims. (Cl. 123—173)

This invention relates to improvements in internal combustion engines.

The primary object of the invention is to provide for the substantially uniform circulation of a cooling medium around the walls of the cylinders of an internal combustion engine. With the present-day, high-compression, large-bore internal combustion engine construction, it is quite necessary that the piston temperature be kept uniform and as low as possible, both on its head and skirt, to prevent detonation and to maintain the oil film on the interior of the cylinder wall. Hence, it is desirable to maintain a uniform circulation of the cooling medium through the jacket usually provided around the wall of the cylinder.

A further object of the invention is to provide means within the cooling fluid circulating jacket which will cause the incoming cooling fluid to circulate entirely around the cylinder wall, so that a uniform flow of fluid upwardly along the cylinder wall from the point of admission will be obtained, as distinguished from a greater cooling effect being exercised in proximity to the point of admission than at other points remote from said point of admission of the cooling medium.

A still further object is to provide a connection between the upper end of the cylinder and the encasing jacket by which a fluid-tight joint will be maintained at all times, notwithstanding radial expansion of these members.

Another object is to provide a connection between the cylinder and jacket consisting of mating screw threads wherein each pair of mating threads is formed with contacting surfaces disposed in a plane at right angles to the axis of the cylinder so that, upon radial expansion, these contacting surfaces will remain in contact, substantially sliding upon one another, as distinguished from moving away from one another and thus opening the joint.

Still another object is to provide what might be termed a floating mounting of the cylinder on the engine base. More specifically, the invention contemplates a liquid seal between the cylinder and engine base formed by a body of resilient packing material which, when assembled, is only partially compressed so that longitudinal or axial expansion of the cylinder can be compensated for by further compression of this packing member.

Another object consists in providing supplementary means for retaining this resilient packing member in position during assembly of the cylinder and jacket on the engine base.

With these and other objects in view, the invention consists in certain details of construction and combinations and arrangements of parts, all as will hereinafter be more fully described and the novel features thereof particularly pointed out in the appended claims.

In the accompanying drawings, illustrating the preferred embodiment of the invention—

Figure 1 is a sectional view taken longitudinally of an internal combustion engine cylinder and the jacket which encloses the same;

Fig. 2 is a transverse sectional view on the line 2—2 of Fig. 1;

Fig. 3 is a transverse sectional view on the line 3—3 of Fig. 1;

Fig. 4 is a detail perspective view of the exterior surface of the lower portion of the cylinder wall; and

Fig. 5 is an enlarged sectional view taken longitudinally of the cylinder wall, more clearly illustrating the threaded connection between the jacket and cylinder.

The upper portion of the base or crank case of the engine is indicated at 10 and, extending upwardly from the base is a jacket 11 which encloses the cylinder 12, there being a space 13 between the cylinder and jacket for the circulation of a cooling medium around the cylinder. Above this jacket there is the engine head 14 but, as the construction of the engine head forms no part of the present invention, a detailed description thereof is unnecessary. The piston is indicated at 15 and the connecting rod for the piston at 16.

The cylinder 12 is secured in the upper portion of the jacket 11, the upper end of the cylinder being threaded so that it may be screwed into a correspondingly threaded portion of the jacket. The cylinder is formed essentially by a sleeve, preferably of steel, and the jacket is preferably a body casting of aluminum, although the particular material will depend somewhat upon the use to which the engine is to be placed. In order to compensate for radial expansion of the cylinder and jacket, the threads by which one is screwed into the other are preferably of the "buttress" type. That is, the mating threads on the two parts are formed with one pair of contacting surfaces 30, 31, disposed in a plane at right angles to the axis of the cylinder while the other pair of contacting surfaces are at an angle thereto. As a result, upon radial expansion of the jacket and cylinder, these surfaces 30, 31 of the threads will merely slide, so to speak, upon one another and thus maintain the sealing contact therebetween. Thus, the joint between the

cylinder and jacket, at what might be termed the upper end of the fluid-circulating chamber 13, is always maintained liquid tight.

It is, of course, essential that a liquid seal be maintained at the lower end of the fluid chamber 13. For this purpose, a body of resilient packing material 17, preferably a synthetic rubber or other soft material is provided in a recess or space between the cylinder 12 and the lower extremity of the jacket 11. Preferably, the cylinder is formed on its exterior surface with an annular flange 18, and the jacket is formed on its interior with an opposing flange 19, the flanges, jointly, forming the inner wall of the recess in which the packing material 17 is received. To facilitate assembly of the structure, the exterior surface of the sleeve is provided with a circumferentially extending recess 20 for reception of a snap ring 21. Ordinarily, a steel ring 22 is placed against the otherwise exposed surface of the packing 17 and the spacing of the recess 20 with respect to the lower edge of the jacket 11 is such that, with the snap ring 21 in place in its recess 20, the packing 17 will be slightly compressed, at least to a point where the steel ring 22 is partially above the lower extremity of the jacket or somewhat within the packing recess between the jacket and cylinder. Thus, the snap ring will hold ring 22 and the packing material in place between the cylinder and jacket until these parts are finally assembled on the engine base 10. As will be noted, particularly in Fig. 1, when the cylinder and jacket are assembled on the base, the jacket is clamped by bolts (not shown) against the surface of the base. With the jacket and cylinder in the position shown in Fig. 1, the engine base 10 causes the steel ring 22 to be further pressed into the packing recess or until the exterior face of the ring lies flush with the end of the jacket. This, of course, still further compresses the packing 17, but even when under this compression the packing is not fully compressed. The packing thus being still only partially compressed, the cylinder may be said to have a floating mounting on the base, in the sense that, when the cylinder becomes heated in operation of the engine and tends to expand axially or longitudinally, the rib or shoulder 18 on the exterior wall thereof can further compress the packing 17.

To facilitate installation of the cylinder sleeve in the jacket, the exterior wall of the cylinder may be formed with a number of axially extending slots 23 which, in the present instance, intersect the snap ring slot 20. By reason of the presence of these slots 23, an adapter which engages said slots may be used for screwing the sleeve or cylinder into the jacket. It will be understood that, in assembling the engine, the cylinder sleeve is first screwed into the jacket, after which the packing 17 and steel ring 22 are secured between the cylinder and jacket by the snap ring 21 which will retain the packing in place until the cylinder and jacket are to be mounted on the engine base. The use of the snap ring 21 as a temporary retaining means for the packing 17 is of further advantage in that the cylinder and jacket, with the packing thus held therein by the ring 21, can be tested for leakage. If the joint does not leak when the packing is merely held in place by the snap ring 21, it necessarily follows that the joint will be absolutely liquid tight when the packing 17 is still further compressed at the time it is mounted on the engine base which operation, as above pointed out, still further compresses the packing. The ability of the cylinder sleeve to

float, so the speak, on the packing 17, eliminates, to a great extent, possible distortion of the cylinder under the influence of heat changes.

A cooling medium is supplied to the chamber 13 within the jacket 11 from supply line 24 through a port 25 in the jacket wall and, in accordance with general practice, this point of supply for the cooling medium is very close to the bottom of the jacket chamber. The tendency of the cooling medium, upon entering the jacket at one side thereof, is to flow upwardly in the chamber and, in the absence of means for obtaining a uniform distribution of the fresh incoming medium around the lower portion of the jacket, the upward flow of medium at a point in close proximity to the point of inlet will exceed the upward flow of the medium at a point more remote from the port 25. This, of course, would result in an unequal distribution of the cooler, fresh, incoming cooling medium around the cylinder wall and an unequal cooling effect on the piston. To overcome this difficulty, the present construction embodies means within the cooling medium chamber to restrict the immediate up-flow of the cooling medium from the lower portion of the chamber with the result that it might be said that the cooling medium is forced to circulate entirely around the lower portion of the chamber before flowing upwardly therein. In other words, by preventing the incoming cooling medium from rushing upwardly in the chamber 13, as it enters the port 25, there is a tendency to cause the incoming fluid to flow around the cylinder, so that the upward flow is more uniform and the consequent cooling effect likewise more uniform. In the present instance, this result is obtained by forming, on the exterior wall of the cylinder, an annular shoulder 26 which substantially bridges the space between the cylinder and the inner surface of the jacket. If desired, the jacket itself may be provided with an interior shoulder 27 opposed to the shoulder 26 on the cylinder, as such an arrangement lends to a ready assembly of the structure. The essential point is, however, to substantially close, by means of one or both of these shoulders, the space between the cylinder and jacket wall. In one of these shoulders 26, 27 (in shoulder 26 in the present instance) there are one or more recesses or openings 28, through which the cooling fluid may flow upwardly to the upper end of the chamber 13. The number and size of these openings or passages 28 will depend upon the capacity of the inlet port 25 and, if desired, the several passages 28 may be made of different sizes in order to bring about a uniform flow of cooling medium entirely around the cylinder sleeve. There will, of course, probably be a slight clearance between the shoulders 26, 27, for purposes of assembly, but the openings 28 constitute the main channels or passageways for the flow of the cooling medium upwardly through the chamber 13. Thus, an upward rushing, so to speak, of the cooling medium as it enters through port 25 is prevented and the same is caused to substantially flow to the most remote point in the chamber from the port 25 so that there is a more uniform distribution of the fresh incoming fluid around the cylinder, as a consequence of which a more uniform cooling of the cylinder and piston is obtained.

What I claim is:

1. In an internal combustion engine comprising a cylinder, a jacket enclosing the cylinder and a base on which said cylinder and jacket are mounted, there being a packing recess between

said cylinder and jacket open at one end of the jacket, a body of resilient packing material in said recess, a metal ring positioned against the exposed face of the packing, and a retainer ring carried by the cylinder at a point spaced beyond 5 said end of the jacket to retain the first-mentioned ring and packing material in the recess with the latter under only partial compression.

2. In an internal combustion engine comprising a cylinder, a jacket enclosing the cylinder and 10 a base on which said cylinder and jacket are mounted, there being a packing recess between said cylinder and jacket open at one end of the jacket, a body of resilient packing material in said recess, a metal ring positioned against the 15 exposed face of the packing, and a retainer ring carried by the cylinder at a point spaced beyond said end of the jacket to retain the first-mentioned ring and packing material in the recess with the latter under only partial compression, 20 and means for securing the jacket and the first-mentioned ring against said base to impose a still greater pressure on said packing.

3. In an internal combustion engine comprising a cylinder, a jacket enclosing the cylinder and 25 a base having an opening therein through which

the cylinder extends and on which the jacket is mounted, there being a packing recess between said cylinder and jacket open at one end of the jacket, resilient packing material in said recess, a retainer ring carried by the cylinder for retaining the packing material in the recess under only partial compression, and means for securing the jacket against the base with said retainer ring positioned in said opening in the base and with said packing material positioned to be further compressed by the base whereby additional pressure can be imposed on the packing by the base.

4. In an internal combustion engine comprising a cylinder and a jacket enclosing said cylinder, an annular recess between the cylinder and jacket at one end of the latter, a resilient packing in said recess, a circumferentially extending recess on the exterior surface of the cylinder, said recess being formed in part by circumferentially spaced lugs forming longitudinally extending slots on the exterior surface of the cylinder and a ring seated in said circumferentially extending recess and engaging the packing for retaining the latter in said annular recess.

LOUIS R. SPENCER.